D2L (Desire 2 Learn)

3rd Floor
121 Charles Street, West
Kitchener, Ontario
Canada

Communication Cabling Specification
Issued for Construction Mon January 6, 2014

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PART 1 – GENERAL CABLING STANDARDS

1.01 GENERAL SCOPE OF WORK

.1 This document describes the requirements for furnishing and installing a certified telecommunications cabling infrastructure for a D2L office in Kitchener/Waterloo, Ontario. The client is expanding their current location with ***VoIP system*** at this location. A balanced plenum CommScope Uniprise Cat6 utp twisted-pair cabling system capable of supporting a minimum **250MHz** of bandwidth as described in this document.

.2 The cabling system shall provide data cables from each of the telecommunications outlet/connector (TO) in each work area (WA) back to the cabinet locations on the same floor. All runs will terminate in the cabinets. No permanent link shall exceed 90 m (295 ft), as measured from the cable termination point at each end. An additional 10 m (33 ft) is allowed for cordage at both ends, for a maximum allowable end-to-end or channel length of 100 m (328 ft). ***See drawing for exact quantities and locations***.

.3 Supply and install two white data cabinets with associated hardware on the 3rd floor.

.4 Supply and installation of VGA type cables for TV and ceiling locations (refer to document and drawings for info).

.5 The 2”h x 12”w overhead basket cable tray will be supplied, installed, bonded and grounded by the successful communication cabling contractor on the floor to the data cabinet locations (refer to drawing for routing).

.6 Supply and install 2-12 strand 50/125µm Laser Optimized non-plenum fiber from each data cabinet location on the 3rd floor to the existing server room cabinet TANR7 on the 3rd floor. Fiber to be installed in conduit supplied by the electrical contractor. Any exposed fiber to be enclosed in innerduct.

.7 Supply and install 2-12 strand 50/125µm Laser Optimized non-plenum fiber from the 2nd floor existing data cabinet location to the existing server room cabinet TANR7 on the 3rd floor. Fiber to be installed in conduit supplied by others. Any exposed fiber to be enclosed in innerduct.

.8 All horizontal cabling communication conduits will be installed to the overhead basket cable tray by others.

.9 The fiber conduits will be installed to each of the three cabinets by others.

.10 All cables and related support, termination, and grounding hardware shall be furnished, configured, installed, tested, labeled, and documented by the successful bidder as detailed in this document.

.11 General product specifications, design considerations, drawings and installation guidelines are provided in this package. In case of conflict, this document shall take precedence. The successful bidder shall meet or exceed all requirements for the cabling system described in this document.

.12 Review all associated drawings and specifications.

1.02 REGULATORY REFERENCES AND STANDARDS

.1 All workmanship and materials supplied shall be in full conformance with applicable building, electrical, and other codes, as determined by the authority having jurisdiction (AHJ).

.2 All cabling system components shall be Underwriters Laboratories (UL) Listed and shall be marked as such. In cases where UL has no published standards for a component, any equivalent national independent testing standard shall apply and the item shall be appropriately marked. Where UL has an applicable system listing and label, the entire system shall be labeled.

.3 The product specifications, design considerations, and installation guidelines provided in this document are in part derived from recommendations found in recognized telecommunications industry standards. The following are used as reference:

.1 Spaces and Pathways
ANSI/TIA-569-C Commercial Building Standard for Telecommunications Pathways and Spaces

.2 Grounding
ANSI-J-STD-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

.3 Cabling Systems
ANSI/TIA 568-C.0 Generic Telecommunications Cabling for Customer Premises.

ANSI/TIA 568-C.1 Commercial Building Telecommunications Cabling Standard.

ANSI/TIA 568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards.

ANSI/TIA 568-C.3 Optical Fiber Cabling Components Standard.

.4 Cabling Administration
ANSI/TIA -606-B Administration Standard for Commercial Telecommunications Infrastructure

.5 Networking
IEEE Standard 802.3an (2006) – *10GBASE-T*

.6 Design
BICSI Telecommunications Distribution Methods Manual (TDMM) – 12th edition

.7 Installation
BICSI Information Transport Systems Installation Manual (ITSIMM) – 6th edition

.8 In cases where product specifications, design considerations, and installation guidelines provided in this document are in conflict with the references listed above, the more stringent requirements shall apply. All references listed above were current during development of this publication.

.9 This document does not take precedence over any code, either partially or wholly.

.10 The Communications Cabling Contractor shall ensure that any local permits that are required to be obtained are obtained prior to starting any activity on the client's site and that any labour fair wages and union affiliation requirements are met.

.11 The Communications Cabling Contractor is to read and comply with all sections of this document.

1.03 CABLE MANUFACTURE

.1 The bidder can be a non unionized authorized Communications Cabling Contractor for the approved cabling manufacturer of a **Uniprise 250MHz** solution **(approved manufacture: CommScope). No other substitutes allowed.**

.2 The bidder must have successfully completed all design and installation training provided by the manufacturers and is able to document successful completion of such training upon request.

.3 The bidder shall demonstrate proven expertise in the implementation of network cabling. Expertise can be illustrated through the inclusion of details of at least two projects involving the design and installation of a minimum 250MHz balanced utp twisted-pair cabling systems within the past two-year period. Names and contact information for each of the two projects shall be included in their bid response.

.4 The successful bidder shall hereinafter be referred to as the Communications Cabling Contractor.

.5 The Communications Cabling Contractor shall accept complete responsibility for the installation, acceptance testing, and certification of the successful 250MHz system.

.6 The Communications Cabling Contractor shall provide proof of its current Commscope status and shall deliver a minimum ***250MHz System Certification*** for this project.

.7 All manufacturers' products must meet or exceed the specifications in this document. No alternatives will be accepted except where noted. Bidders must identify alternative products with their bids, including the manufacturer and part number.

.8 All manufacturers products installed must meet or exceed all local, provincial and federal building, fire, health, safety and electrical codes.

.9 The successful cabling contractor and their manufacture must be able to install and support a minimum 20 year warranty.

.10 The successful cabling contractor to provide specification cut sheets and a BOM for all products listed on the BOM.

1.04 APPROVED INSTALLERS

.1 The installation of the 250MHz system shall be performed by an ***authorized contractor from the above approved manufacture.***

.2 The Communications Cabling Contractor may not assign or sub-contract any work without the prior written consent of the Client or their designated representative.

.3 All installation and testing shall be performed by a certified and supervised by individuals qualified to install and test the 250MHz system, in accordance with manufacture requirements. The supervisor(s) shall have successfully completed the manufacture training courses and be able to document successful completion of such training upon request.

.4 The Project Manager and lead tech that start the project must remain on the project until its competition. Changes to the Communications Cabling Contractor's project team may only occur with the prior consent of the client and the Communications Consultant.

.5 The Communications Cabling Contractor must comply with all job-site requirements (including fair wage requirements) for the duration of the project. The Communications Cabling Contractor shall make all necessary precautions, allowances and pre-cautions to comply with labour requirements of all unions on site to ensure that there will not be any disruption of work arising from the successful bidders work or workers.

.6 The Communications Cabling Contractor must comply with all requirements of the Occupational Health & Safety Act.

.7 It shall be the Communications Cabling Contractor responsibility to be aware of all current or impending legislation relating to employees, safety and fire regulations and shall be further required to acquaint their staff with this information. The Communications Cabling Contractor shall be responsible for being aware of all governing local municipal regulations and the Provincial Employment Standard concerning minimum wages, vacation pay, termination of employment etc.

.8 The Communications Cabling Contractor must be in good standing with the Workplace Safety and Insurance Board and the successful bidder will be required to provide to the client a certificate (Workers Compensation) to this effect.

.9 The Communications Cabling Contractor agrees to use only tradesman who are fully trained, qualified and experienced on the installation, termination and testing of a Certified Communication Cabling System. The installer must be an approved installer of the specific cabling system.

1.05 WORK INCLUDED

.1 The work included consists of all labor, equipment, products, and supplies required installing, testing, and certifying the 250MHz solution in compliance with the project specifications.

.2 The work included consists of (but is not limited to) the following:

.1 Pre-registration of the project with the successful manufacturer's Certified Project. A copy of the pre-registration request and manufacturer's approval shall be provided prior to project starting.

.2 Furnishing and installation of a complete balanced utp twisted-pair telecommunications cabling infrastructure capable of supporting 2 Gb/s networking.

.3 Furnishing, installation, termination, labeling and testing of all utp horizontal cabling.

.4 Furnishing, installation, termination, labeling and testing of the fiber backbone.

.5 Furnishing of any other material required to implement a complete system.

.6 Furnishing all test and labeling information in both electronic and paper formats.

.7 Providing training and complete documentation, including the Manufacturer's User Manual, Application Guidelines, and as-built drawings within [10] business days of project completion.

1.06 SUBMITTALS

.1 Under the provisions of this document and prior to the start of work, the Communications Cabling Contractor shall:

.1 Submit Proof of Certification status of their company and the names of all individuals that will be performing the installation and testing to the owner of the 250MHz solution.

.2 Submit details/data sheets of all cabling system products components and/or assemblies to be used to the owner of the CommScope Uniprise 250 MHz solution.

.2 The Communications Cabling Contractor must obtain approval from the manufacturer and from the owner of the 250MHz solution for any substitution of submitted products. No substituted items shall be installed without prior written approval.

1.07 DELIVERY, STORAGE AND INSTALLATION INFORMATION

.1 Delivery and receipt of project materials shall be at 121 Charles Street, West, 3rd floor, Kitchener, Ontario and it will be the sole responsibility of the Communications Cabling Contractor to receive, move, secure and store all equipment and material. All delivery costs are to be included in the Communications Cabling Contractors proposal.

.2 All cable to be used in the project shall be stored according to manufacturer's recommendations. In addition, all cable must be stored in a protected area. If cable is stored outside, it must be covered with opaque plastic or canvas for protection from the elements, with adequate ventilation to prevent condensation. If air temperature at the cable storage location will be below 4.4 °C (40 °F), the cable shall be moved to a heated location [minimum 10 °C (50 °F)]. If necessary, cable shall be stored off-site at the Communications Cabling Contractor's expense.

.3 The Communications Cabling Contractor is allowed one (1) standard size job box on the site during construction. All tools, material and the job box are the sole responsibility of the Communications Cabling Contractor. The Communications Cabling Contractor is responsible for the complete storage, handling, moving, delivery and installation of all materials used in the performance of the work.

.4 The client is not responsible or liable for any missing material and/or tools belonging to the Communications Cabling Contractor.

.5 The Communications Cabling Contractor is responsible for keeping the workspace clean, safe and free from debris at all times. All debris must be removed from the site on a weekly basis. Costs associated for keeping the area clean is the responsibility of the Communications Cabling Contractor.

.6 Cleanliness of the site to be governed by the General Contractor/Construction Manager who may, after proper notice back charge the Communications Cabling Contractor for site clean up.

.7 The Communications Cabling Contractor is responsible for the removal and re-installation of all ceiling/floor tiles in the areas affected by its work. This is to be completed on a daily basis for the areas affected.

.8 Any damage to ceiling tiles during the completion of any work outlined in this document is the responsibility of the Communications Cabling Contractor. Damage includes breaking, chipping or fingerprints. The decision with respect to any damage will be made by the General Contractor Project Manager and the Communications Consultant.

.9 The Communications Cabling Contractor is responsible for the storage and protection of the floor/ceiling tiles that are removed for cable installation.

1.08 DRAWINGS

.1 All drawings and plans provided with this document are diagrammatic. They are included to show the scope of the project in order to assist in the development of bid documents. The Communications Cabling Contractor shall make allowances in the bid proposals to cover the work required to comply with the intent of the drawings, plans and all site conditions.

.2 The Communications Cabling Contractor shall verify all dimensions at the site and is responsible for their accuracy.

.3 Prior to submitting a bid, the Communications Cabling Contractor shall indicate:

.1 Any specified materials the Communications Cabling Contractor believes to be inadequate.

.2 Any necessary items of work omitted from the bid specification.

1.09 SITE VISIT

.1 ***The communication cabling contractors shall make a mandatory visit the site with the cabling specifications, all mechanical, electrical and architectural drawings and complete their own site walkthrough prior to submitting costing and bid documents.***

.2 ***Hard hat, safety vest and safety boots are required.***

1.10 BID RESPONSE AND PRICING

.1 The Communications Cabling Contractor shall have a proven track record in cabling projects of a similar size to the one being tendered. The letter must include names, address and phone numbers of references for the two projects.

.2 Prices to be submitted are for a complete and functioning twisted-pair cabling system as intended in this specification. Prices are to include incidental fees and other fees for items required (that may or not be indicated in this document) to successfully install the cabling system. A successful installation of the cabling system is one that meets the requirements of this document, meets all local, provincial and federal building, safety fire and electrical codes, as well as all manufacturer's recommended guidelines.

.3 The Communications Cabling Contractor is required to report all errors and omissions in this document to the Communications Consultant with their Bid submission.

.4 Prices included in the bid response shall include a breakdown for labour and material.

.5 The bid response shall include a detailed list of all material and part numbers in accordance with Appendix "A" in this document. Failure to do so will result in immediate disqualification.

.6 The bid response shall include the Unit Price Schedule in accordance with Appendix "B" in this document. Failure to do will result in immediate disqualification.

.7 Bidders who find discrepancies or omissions in this RFP, or who have any doubt as to the meaning or intent of any part of this RFP, shall direct their questions or other inquires in writing to :

SDW Cabling Consulting Inc.
2381 Deer Run Ave
Oakville, Ontario
Tel: 905-901-9148
Email: sdwcabling@cogeco.ca
Attention: Syd Woodward, RCDD

All questions will be answered and distributed to all bidders within 24 hours of receipt. Oral questions will not be answered. Questions will not be accepted or answered within 48 hours prior to the closing of the bid.

1.11 PAYMENT

.1 The value for testing and documentation shall be set at 15% of the contract price for payment purposes. This amount will be withheld from the Communications Cabling Contractor until the testing and the correction of all deficiencies are 100% complete and all specific documentation has been handled over to the Communication Consultant. This amount will be in addition to any standard construction holdback that is withheld from the Communications Cabling Contractor.

PART 2 – PRODUCTS

2.01 SYSTEM OVERVIEW

.1 The balanced utp twisted-pair cabling system shall be available in bonded pair and/or non-bonded pair configurations.

.2 The balanced twisted-pair cabling system shall provide guaranteed performance up to a minimum of 250MHz and shall meet the specifications listed below for a 4-connector, 100 m (328 ft) channel.

NOTE: 4-connector refers to one telecommunications outlet (TO), one consolidation point (CP), and two cross-connect panels in a TE/TR/ER/IT (one for horizontal cables and one for equipment pigtails).

NOTE: The values listed above are characterized as “Margin” or “Guaranteed Headroom” beyond the performance specified in standards, and serve as additional assurance of the cabling system’s performance after installation and over its operational lifespan.

(*) Value proposed represent guaranteed margin against Draft 1st Amendment to ISO/IEC 11801 Edition 2.0 specification extrapolated to 250MHz

2.02 BALANCED TWISTED-PAIR CABLES

.1 The 4-pair balanced utp twisted-pair cables shall be available in bonded pair and/or non-bonded pair configurations. The characteristics listed below shall apply to both configurations.

.1 The cables will be non-plenum rated (CMR). The minimum recommended installation temperature shall be 5 °C (40 °F). The temperature rating shall be 60 °C (140 °F).

.2 The colour of the horizontal 250MHz data cable shall be **WHITE**.

.3 The cables shall have randomization elements along their lengths and on their cross-sections to minimize alien near-end crosstalk (ANEXT) coupling.

.4 The cable conductors shall be 23/24 AWG solid copper.

.5 The nominal outside diameter (OD) shall be no greater than 8 mm (0.315 in) for CMR-rated cable and 7.87 mm (0.31 in) for CMP-rated cable.

.6 The minimum bend radius shall be no greater than four times the OD of the cable.

.7 The transmission characteristics of the cable will be guaranteed to a minimum of 250 MHz. The guaranteed values will be as follows:

Maximum DC resistance (at 20 °C)	7.4 ohms/100 m (328 ft)
Maximum DC resistance unbalance	3 %
Maximum mutual capacitance	5.7 nF/100 m (328 ft)
Maximum capacitance unbalance (pair to ground)	50 pF/100 m (328 ft)
Maximum propagation delay skew	35 ns/100 m (328 ft)

NVP – plenum	72% @ 10 MHz
NVP – non-plenum	68% @ 10 MHz

DC = Direct current

NVP = Nominal velocity of propagation

2.03 UTP CONNECTORS

.1 The connectors used to terminate the 4-pair balanced twisted-pair cable shall have the characteristics listed below.

.1 The connectors shall be modular in form, with available mounting options for TOs and modular angled type patch panels. The dimensions of the connectors shall be as follows:

- 19.8 mm (0.78 in) in height
- 16.3 mm (0.64 in) in width
- 29.0 mm (1.14 in) in depth

.2 The PSANEXT isolation between modules must be greater than 70dB @ 100MHz when connectors are mounted side by side, top to bottom in a 48 ports 1U configuration.

◭ = Data A and Data B

△ = Data (1)

CAM = One data

WAP= One Data

.3 The 1st data RJ45 module in the faceplate and for the black 24/48 port modular angled type patch panel will be **BLUE**.

.4 The 2nd data RJ45 module in the faceplate and for the black 24/48 port modular angled type patch panel will be **GREEN**.

.5 The **YELLOW** wireless data RJ45 will be required for each wireless AP outlet.

.6 The **BLACK** camera data RJ45 will be required for each camera location.

.7 Confirm all part numbers and colours before ordering with communication consultant.

2.04 UTP PATCH CORDS

.1 The work area cords, patch cords, shall have the characteristics listed below.

.1 The cordage shall use 23/24 AWG solid or stranded copper conductors in a bonded pair configuration for reliable long-term channel performance to 250 MHz.

.2 The nominal cable diameter of the cordage shall be no greater than 6.62 mm (0.26 in). The minimum bend radius shall be 26.5 mm (1.04 in).

.3 The cordage shall be available in multiple colors. Quantities listed below. **Supply and install all patch cords at cabinet and faceplate location listed below.**

PATCH CORDS	LENGTH	QUANTITY
Blue (workstation)	7'-0"	One per data cable
Blue (cabinet)	4'-0"	80% per data cable
Blue (cabinet)	7'-0"	20% per data cable
Green (workstation)	7'-0"	One per data cable
Green (cabinet)	4'-0"	80% per data cable
Green (cabinet)	7'-0"	20% per data cable
Yellow (wireless location)	4'-0"	One per data cable
Yellow (cabinet)	7'-0"	One per data cable
Black (cabinet)	7'-0"	One per data cable
Black (camera location)	4'-0"	One per data cable

.4 When mated to a connector, the transmission characteristics of the cordage will be guaranteed to a minimum 250 MHz. The minimum guaranteed values at 250 MHz will be as follows:

NEXT	38.1 dB
PSANEXT	54.1 dB
Return loss	12.1 dB

NEXT = Near-end crosstalk

PSANEXT = Power-sum alien near-end crosstalk.

2.05 VERTICAL POWER BAR

.1 Fabricated from 18 GA (0.048") steel.

.2 Slim profile power bars mount into 19" EIA cabinet frames or network racks.

.3 Features breaker protection with reset button, three-stage surge protection, three-prong power cord and power outlets.

.4 Illuminated power switch showing power "ON".

.5 Comes standard with a 6-10' power cord Nema 5-20P.

.6 Plug may be straight blade or twist lock.

.7 Comes with a minimum of 10 Nema 5-15/20R outlets.

.8 Approved manufacture is Netversity.

2.06 DATA CABINET

.1 Frames are to be constructed of rugged heavy gauge steel.

.2 All welded construction.

.3 30"w x 36"d x 83" high foot print.

.4 Lockable perforated split front doors.

.5 Lockable perforated split rear doors.

.6 Solid side panels.

.7 Two sets of mounting angles punched to EIA/TIA universal spacing cage nuts.

.8 Minimum one two post ground lug.

.9 The top lid of the cabinet is to have a minimum of six 4" holes (2 for fans/4 for cabling). Include plates for holes not required.

.10 One set of two fans with 4 foot power cords to connect to power bar at the rear of cabinet.

.11 Cabinet colour is **WHITE**.

.12 Two vertical wire managers (3-1/2" w x 9"d).

.13 Approved manufacture is Netversity

2.07 MODULAR ANGLED DATA PATCH PANELS

.1 The rack mountable **angled** modular patch panel **shall be** either 24 port (1U) or 48 port (2U) modular type patch panels.

.2 All patch panels mount in 19" EIA standard mountings.

.3 Patch panels will be BLACK.

2.08 FIBER PATCH PANELS

.1 The rack mountable fiber patch panels shall be used for cross-connecting or interconnecting purposes.

.2 The fiber optic patch panel shall be mounted in a 19” (482mm) rack.

.3 The fiber optic patch panel shall be 1U high and be black in colour.

.4 The unit shall have a patch cord routing guides that allow a transition and segregation for fiber optic patch cords to exiting the sides of the fiber patch panel.

.5 The fiber optic patch panel allows for splicing with optical pigtails using a splice organizer tray.

2.09 OPTICAL FIBER ADAPTER STRIPS

.1 An adapter strip is defined as a modular removal plate containing fiber optical connectors.

.2 The adapter strip shall utilize a single mounting footprint and the colour shall be black.

.3 The adapter strip shall be attached with two push-pull latches to allow for quick installation and removal.

.4 The double density six (6) “LC” adapter strip shall be Phosphor Bronze for multimode and Zirconia Ceramic for Single mode fiber.

2.10 MULTIMODE “LC” FIBER CONNECTORS

.1 The fiber optic “LC” connector shall be field installable 50/125µm connectors for Laser Optimized multimode fiber.

.2 The connector shall provide a strain relief mechanism for installation of a single strand of fiber that contains strength elements. The fiber within the body of the connector shall be isolated mechanically from cable tension bending and twisting.

.3 The connector must be capable of mounting on either 900 micron tight buffered fiber, 3.0mm jacketed fibers and 250 micron loose tube fibers.

.4 The connector shall have a ceramic ferrule and a factory PC polish.

.5 The connector must have a locking feature to the coupler.

2.11 OPTICAL FIBER PATCH CORDS

.1 Duplex fiber optic patch cords, Multimode 50/125µm Laser Optimized equipped with LC to LC connectors.

.2 Cables are to meet the same performance criteria for 50/125µm multimode Laser Optimized type fiber.

.3 Patch cords are to be factory assembled and note site prepared.

.4 LC to LC patch cords shall be 7'-0" (2m) in length (cabinet). (quantity is 30)

.5 LC to LC patch cords shall be 10'-0" (3m) in length (DC). (quantity is 30)

2.12 OVERHEAD CABLE TRAY

.1 The successful Communications Cabling Contractor is responsible for the **2"h x 12"w *overhead basket tray system*** including supply, installation, grounding and bonding of the tray system based on the communication drawings (floor and cabinet area). It will be installed as indicated on the floor plans to provide the main trunk paths for the cable plant including the cable tray above both cabinets.

.2 Basket tray height is to match the HVAC system. Coordinate with all trades and the GC to determine exact height.

.3 Allow for changes to the routing of the overhead cable tray may change due to onsite conditions.

.4 Ensure overhead cable tray is properly supported to prevent swaying.

.5 The Communications Cabling Contractor is to report back to the Communications Consultant and the GC any concerns related to the installation of the tray.

.6 The Communications Cabling Contractor must be fully trained and authorized on either CER (Canadian Electrical Raceway), Flex Tray, Cablofil or WBT overhead cable tray products.

.7 The following two methods will be allowed to support the cable tray (Profile or Trapeze) type hardware.

.8 Drop-Outs shall be incorporated in the overhead cable tray into the cabinets for the horizontal and backbone type cabling.

Overhead Basket Cable Tray

PART 3 – EXECUTION

3.01 WORK AREA INSTALLATION

.1 Work area TO's (Telecommunication Outlet) shall be installed in accordance with:

.1 Standards-based recommendations.

.2 The manufacturer's recommendations and installation guides.

.3 Industry best practices.

.2 Cables shall be dressed and terminated in accordance with:

.1 Standards-based recommendations.

.2 The manufacturer's recommendations and installation guides.

.3 Industry best practices.

.3 Slack cable to be coiled if adequate space is provided to house the slack cable without exceeding the manufacturer's installation guidelines. Include a minimum of 5 feet of slack at the cable tray location for the workstation (stored in accordance with manufacturer's installation guidelines) to allow for future outlet relocation.

.4 For all wireless and camera locations include 30 feet of slack at the cable tray for future relocation.

.5 Pair untwist at the termination point shall not exceed 13 mm (0.5 in).

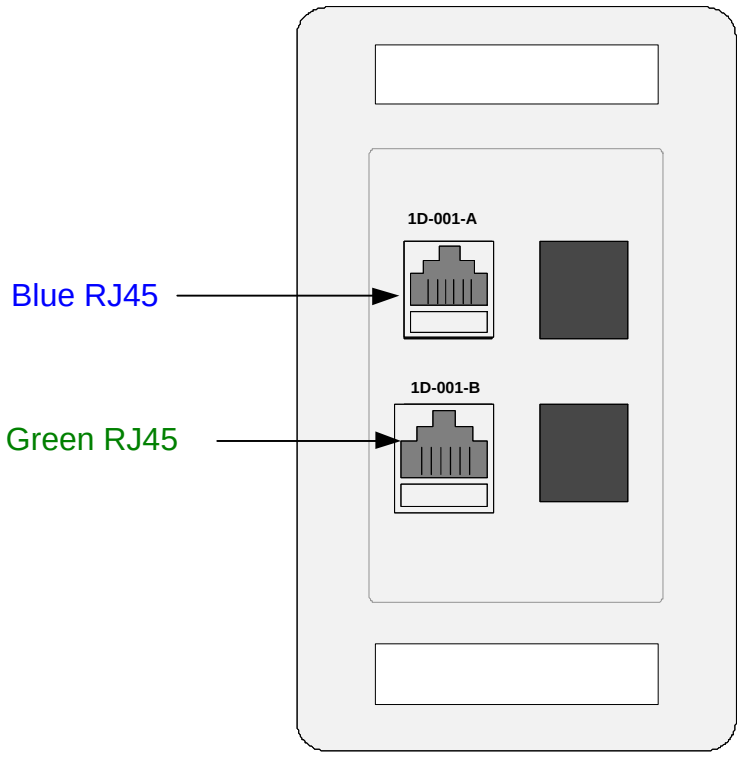
.6 Bend radius of the cable in the termination area shall not be less than 4 times the OD of the cable.

.7 The 1st data RJ45 connector at the outlet will be **BLUE** in colour and shall occupy the top position of the decora (minimum 3 holes) or 4 port type white faceplate (top to bottom). The 1st data RJ45 connector in the horizontally oriented faceplates shall occupy the top left-most positions. Use blanks for all unused ports. Blanks to match faceplate color

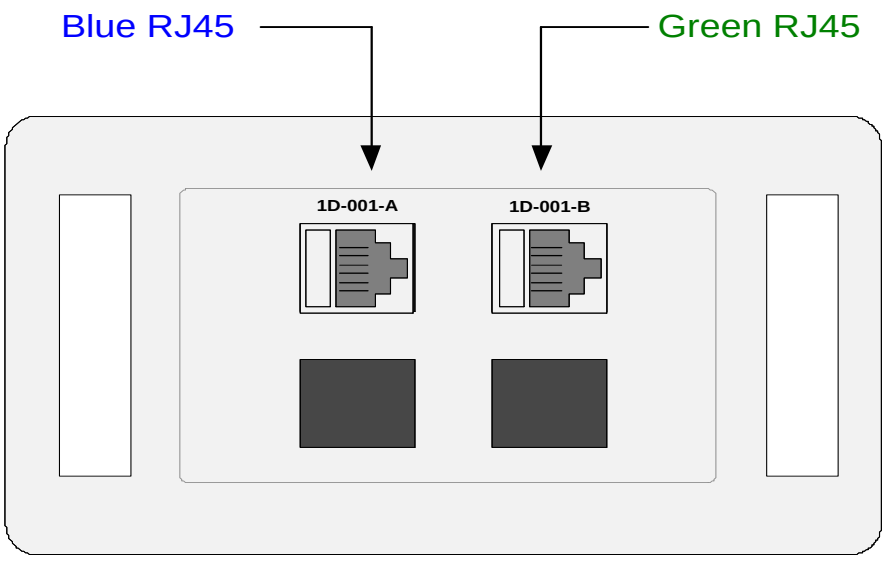
.8 The 2nd data RJ45 connector at the outlet will be **GREEN** in colour and shall occupy the bottom position of the decora (minimum 3 holes) or 4 port type white faceplate (top to bottom). The second data RJ45 connector in the horizontally oriented faceplates shall occupy the far right most position. Use blanks for all unused ports. Blanks to match faceplate color.

.9 Faceplate colour to match electrical.

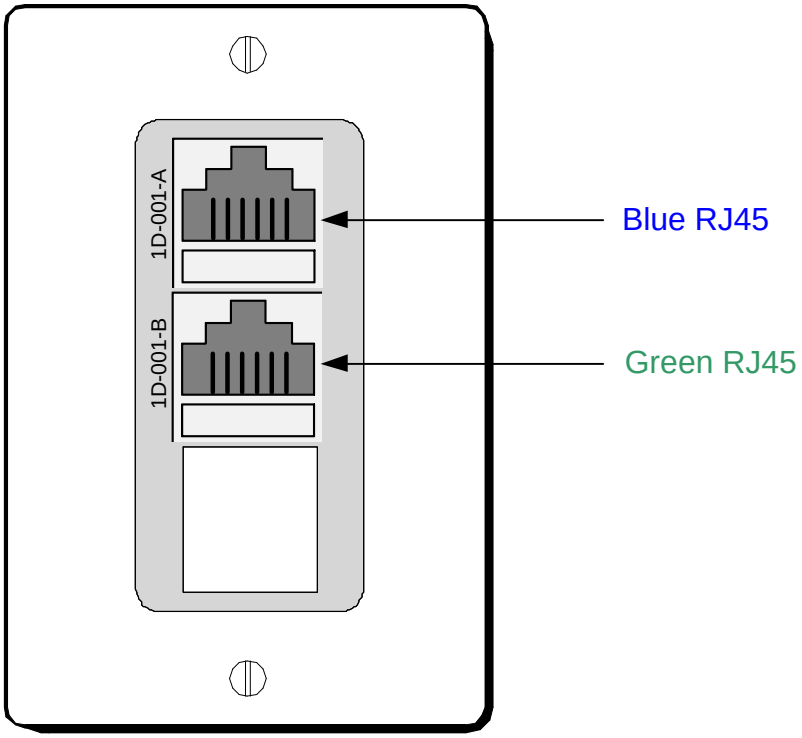
.10 Refer to faceplate drawings in this document for more information.



Wall Faceplate



Horizontal Faceplate



Decora Faceplate

.11 Wireless data RJ45 connectors will be **YELLOW** in colour and shall occupy a two port white side entry box.

.12 Camera data RJ45 connectors will be **BLACK** in colour and shall occupy a two port white side entry box

.13 Where communications is ganged with electrical decora type inserts are to be used and the colour is to match electrical.

.14 Where the communications cabling is terminated at a furniture workstation 4 port white faceplate shall be installed. Where applicable, use blanks for all unused ports. All blanks to match faceplate color.

.15 Where the communications cabling is terminated in the various floor monuments, include all faceplate brackets, keystone type jacks and faceplates for terminating the cables. Where applicable, use blanks for all unused ports. All blanks to match faceplate color.

.16 Leave three feet at the wall locations and 10 feet at the floor locations for the VGA cabling.

.17 Include all necessary furniture adapters/spacers etc in your pricing to ensure the faceplate can be properly installed in the furniture while maintaining a proper bend radius of the Cat6 cables.

3.02 HORIZONTAL CABLE INSTALLATION

.1 Cable shall be installed in accordance with:

.1 Standards-based recommendations.

.2 The manufacturer's recommendations and installation guides.

.3 Industry best practices.

.2 All cable ties shall be black Velcro style. ***Plastic cable ties are not allowed for final connection***. If found on site during any phase of the project, the plastic cable ties will be removed, along with all cabling components contained within them, and the removal and the re-cabling shall be at the Communications Cabling Contractor's expense.

.3 All exposed cables in the cabinet are to be placed in a neat and professional manner and routed in accordance with the specifications, best practices and drawings provided.

.4 Use conduits and overhead basket cable tray pathways for all horizontal cabling.

.5 All exposed cabling at the workstation between the wall/floor and the furniture access locations is to be wrapped with black split loom tubing manufactured by PANDUIT Canada, size and length as required to suit.

.6 No cable shall exceed 90 meters. Any cables longer than 90 meters shall be reported immediately to the communications consultant.

.7 Cable raceways shall not be filled greater than the TIA/EIA-569-C recommended maximum fill for the particular raceway type, or 40% whichever is less.

.8 ***At no point shall any horizontal cable(s) rest on or be supported by acoustic ceiling grids hangers, water pipes, HVAC, metal conduits or ceiling panels.***

.9 Horizontal cables shall be installed above fire-sprinkler systems and shall not be attached to such systems or any associated ancillary equipment or hardware. The cabling system and its associated pathways shall be installed so that they do not obscure any valves, fire alarm conduit(s), boxes, or other control devices.

.10 Horizontal cables shall not be attached to ceiling grid support rods, conduits, water pipes HVAC ducts or lighting fixture wires. Where support for horizontal cable is required, the Communications Cabling Contractor shall install appropriate carriers to support the horizontal data cabling listed in this document.

.11 Any cable(s) damaged or exceeding recommended installation parameters during installation shall be replaced by the communication contractor prior to final acceptance at no cost to the owner of the cabling system.

.12 The horizontal cabling shall be self-supporting.

.13 All cables shall be identified by a self-adhesive label in accordance with the System Documentation section of this document and TIA/EIA-606-B standard.

.14 The data cable label shall be applied within four inches on the cable behind the faceplate, within four inches of the data patch panel termination.

.15 Balanced utp twisted-pair cable shall be installed so that there are no bends smaller than 4 times the OD of the cable at any point in the run.

.16 The Communication Cabling Contractor is responsible for supply and installation of all split faceplates for furniture locations and where ganged with electrical.

.17 To minimize any possibility of disruption, maintain the following minimum clearances from electrical and heat sources when routing cables:

CLEARANCES TABLE	
Item	**Minimum Clearance**
Motor	1.2 m (4'-0")
Transformers	1.2 m (4'-0")
Conduit and cables used for electrical distribution less than 1kV	0.3 m (1'-0")
Conduit and cables used for electrical distribution greater than 1kV	1.0 m (3'-0")
Fluorescent Luminaires	12 cm (5")
Pipes (gas, oil, water, etc)	0.3 m (1'-0")
HVAC (equipment, ducts, etc	15 cm (6 ")

3.03 DATA CABLE INSTALLATION

.1 Cables shall be dressed and terminated in accordance with:

.1 Standards-based recommendations.
.2 The manufacturer's recommendations and installation guides.
.3 Industry best practices.

.2 All horizontal data cabling shall be 4pr non-plenum rated CMR cable.

.3 At the workstation faceplate, terminate each data cable on 250MHz type, 8 RJ45 position jack wired 568A ISDN standard.

.4 In the cabinet the horizontal data cabling from the workstations (A/B) will be terminated on 24/48 port modular angled type patch panels that are properly secured to the data cabinet.

.5 In the cabinet the data cabling for the wireless and camera locations will be terminated on a 24 port modular angled type patch panel that are properly secured to the data cabinet. Leave space for future growth in patch panel.

.6 In the data cabinet the data A and data B will be terminated above each other in the patch panel going left to right (confirm exact termination locations prior to terminating in cabinet).

.7 The Cat6 cable from the floor monument to the overhead location shall be terminated on each end with orange colour RJ45 type jacks in a proper housing.

.8 The Cat6 cable from the floor monument to the TV location shall be terminated on each end with black colour RJ45 type jacks in a proper housing.

.9 The pair untwist at the termination point shall not exceed 13 mm (0.5 in).

.10 The bend radius of the cable in the termination area shall not be less than 4 times the OD of the cable.

.11 Cables shall be neatly bundled, dressed, and routed to their respective termination connectors.

.12 Each cable shall be clearly labeled on the cable jacket within 4 inches of the termination behind the 250MHz connector at each end. Labels obscured from view will not be acceptable and will be replaced by the Communications Cabling Contractor at no cost to the client.

.13 The Communication Cabling Contractor is to follow the horizontal cable installation section and other sections outlined in this document.

3.04 FIBER BACKBONE INSTALLATION

.1 The fiber backbone shall be terminated in a new fiber patch panel in each of the data cabinets (3rd and 2nd floor) and in the client's server room cabinet labeled TANR7.

.2 When installing the fiber optic cable into the fiber optic patch panel secure the aramid yarn to the patch panel with the tie down provided.

.3 Terminate the fiber optic cable in the appropriate cabinet mounted fiber patch panel located at the top of the data cabinet using the "LC" type connectors.

.4 Leave 15 feet of slack in cabinet TANR7 for future relocation.

.5 Terminate, test, label and document all strands as specified in this document.

.6 Terminating the fiber in the 3rd floor data center may change to an existing patch panel. Allow for this change in your costing.

3.05 POWER BAR INSTALLATION

.1 Two power bars shall be installed in each of the two data cabinets and not to interfere with the cabling.

.2 Both power bars may be connected to the clients UPS system or in electrical outlets on the wall or overhead cable tray.

.3 Include in your costing all labour and all associated hardware to convert the plugs if required to complete the connectivity to the UPS system.

3.06 DATA CABINET INSTALLATION

.1 Supply and install two 30”w x 36”d x 83”h **WHITE** cabinets.

.2 Ground the rack as per section 3.07.

3.07 GROUNDING AND BONDING SYSTEM

.1 The telecommunications bonding backbone (TBB) shall be designed and/or approved by a qualified Professional Engineer (PE), licensed in the jurisdiction where the work is to be performed. The TBB shall adhere to the recommendations found in ANSI-J-STD-607-B and shall be installed in accordance with industry best practices.

.2 A licensed electrical contractor shall perform the installation and termination of the main bonding conductor to the building service entrance ground.

.3 The grounding and bonding approach recommended in this specification shall meet the requirements of all current Canadian codes and standards and is intended to work in concert with the cabling topology as specified in this document.

.4 The telecommunications grounding and bonding infrastructure supports a multivendor, multiproduct environment as well as the grounding practices for various systems that may be installed on the customer premises.

.5 A separate ground shall be established for the telecommunications system. Where this is not possible the telecommunications system ground shall be tied into the building/electrical ground.

.6 Grounding to the conduit system or cold water pipes will not be permitted.

.7 One #6 AWG ground wire shall be installed with proper mounting hardware from each data cabinet to the TGB (Telecommunications Grounding Bus Bar) using 2 hole crimped lugs located at the cabinet location by the cabling contractor.

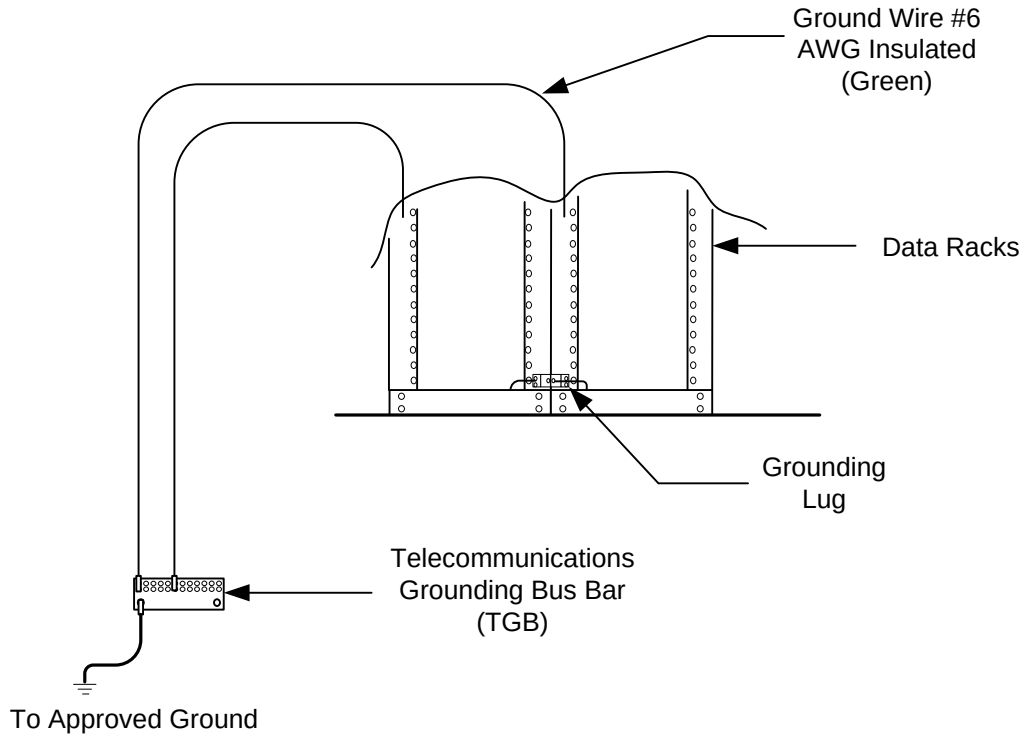
.8 Each section of the overhead cable tray needs to be bonded with proper mounting hardware from the TGB using 2 hole crimped lugs located at the cabinet location by the cabling contractor.

.9 One #6 AWG ground wire shall be installed with proper mounting hardware from the overhead cable tray to the TGB using 2 hole crimped lugs located at the data cabinet by the cabling contractor.

.10 The grounding and bonding of the telecommunications system (cable tray and cabinet) shall meet all local, provincial and national codes and bylaws.

.11 The grounding and bonding of the telecommunications system shall meet all BICSI and JSTD-607-B requirements.

.12 Ensure that metal to metal contact is made when grounding to paint or powder coated surfaces for all patch panels.



Equipment Rack Grounding Configuration

3.08 FIRE STOPPING

.1 All fire stop systems shall be installed in accordance with the manufacturer's recommendations and installation guides and shall be available for inspection by the [AHJ] prior to acceptance.

.2 All fire stopping must meet applicable federal, provincial and local building codes.

.3 Supply and install non-permanent CSA approved intumescent fire stopping, cap all empty sleeves, slot and penetrations and around cabling passing through sleeves, cable trays, slots and penetrations.

3.09 IDENTIFICATION AND LABELING

.1 Labeling shall be in accordance with:

.1 The recommendations found in TIA/EIA-606-B.

.2 The manufacturer's recommendations and installation guides.

.3 Industry best practices.

.2 All adhesive cable labels shall meet the legibility, defacement, and adhesion requirements specified in UL 969 (Ref. D-16). In addition the labels shall meet the general exposure requirements in UL 969 for indoor use.

.3 Cable Labels shall be self-laminating vinyl construction with a white printing area and a clear tail that self-laminates the printed area when wrapped around a cable. The clear area should be of sufficient length to wrap around the cable at least one and one-half times.

.4 Labels are to be mechanically printed using a laser printer and are to follow the guidelines in TIA/EIA-606-B for colour coding.

.5 ***Hand written labels are not permitted on any horizontal or backbone cabling, faceplates and patch panel's hardware.***

.6 Label all cables in accordance with this document and 606-B Standards. One label should be attached to the front of the workstation faceplate, one to the front of the patch panel, and one within 4 inches of each end of the horizontal utp cable.

.7 The labeling scheme for this project is as follows: Data = Floor number-D-001-A/B to Floor number-D-999-A/B, Wire Access point = Floor number - WAP-001 to Floor number- WAP-999 and Camera = Floor number-C-001 – C-999 (***D=Data, WAP=Wireless Access Point and C=Camera).***

.8 Contact communication consultant before ordering labels for cables, faceplates and patch panels.

3.10 TESTING AND ACCEPTANCE

.1 General

.1 All terminated horizontal cabling runs shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements found in the TIA/EIA-568-C series of standards. All pairs in each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation, including (but not limited to) cables, connectors, and cordage shall be repaired or replaced in order to ensure 100% usability of all installed runs.

.2 Acceptable testers are as follows:

Fluke DTX-1800, Fluke DSX 5000 or equivalent.

.3 Upon completion of the testing by the Communications Cabling Contractor, the Communications contractor may be ask to submit the test results for the various work activities to the client or their designated representative within two business days.

.4 Failure to provide test results upon request will require the communication cabling contractor to retest the all horizontal cabling related to the project with no cost to the client.

.5 All Cat6 horizontal permanent link tests are to be performed using a LEVEL III tester equipped with the most recent version of its firmware and in accordance to ANSI/EIA/TIA-568-C series standard and has been calibrated within in one year of testing date.

.6 All OM3 fiber strands are to be performed using a LEVEL III tester equipped with the most recent version of its firmware and in accordance to ANSI/EIA/TIA-568-C series standard and has been calibrated within in one year of testing date.

.7 Ensure all launch testing cables and connectors are within the parameters set by the manufacture for the number of insertions for copper and fiber.

.2 Copper Channel Testing

.1 All balanced twisted-pair cable links shall be tested for basic continuity and length, as indicated below. Additional testing parameters to verify compliance with the 250MHz performance are listed in the System Overview section of this document (Section 2.1.).

.2 Of the parameters listed in [Section 2.1.], it is understood that PSANEXT requires more elaborate measurement instruments and this feature may not be available using current field test equipments. If this feature is available such test will be done on a sampling basis, and analyzed using statistical techniques.

.3 Continuity – Each pair in every installed cabling run shall be tested using a test set that detects and identifies opens, shorts, polarity and pair reversals, crossed pairs, and split pairs. The results shall be recorded as Pass/Fail (as indicated by the test set) and referenced to the appropriate cable identification number and circuit/pair number. Any fault shall be corrected and the run re-tested prior to final acceptance.

.4 Length – Every installed cabling run shall be tested for installed length. The cable length for a permanent link shall not exceed 90 m (295 ft). The cable length shall be recorded, referencing the cable identification number and circuit/pair number.

TIA/EIA-568-B.

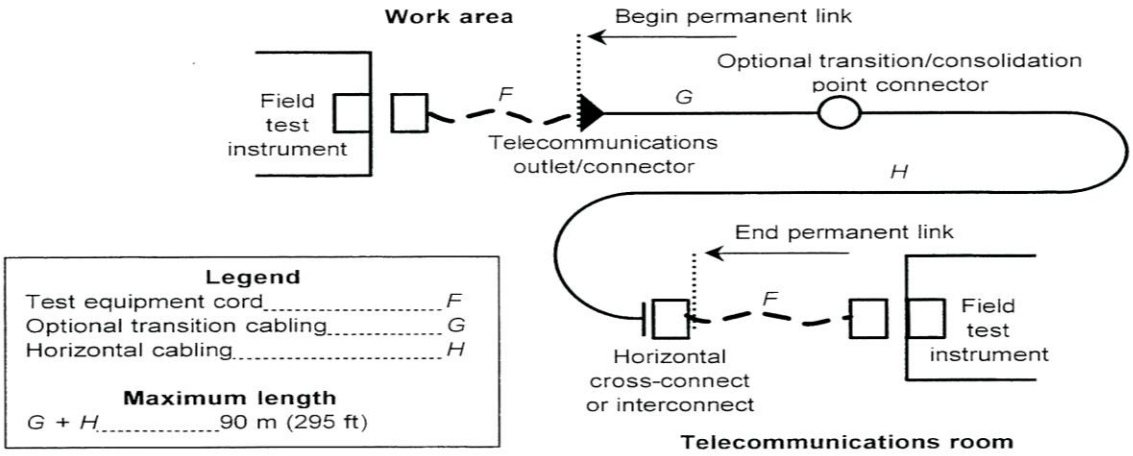


Figure 11-2 Schematic representation of a permanent link test configuration

NOTE – If cross-connections are used, then channel testing is recommended.

3.11 SYSTEM DOCUMENTATION

.1 Upon completion of the installation, the Communications Cabling Contractor shall provide **two (2) marked up cable drawings** indicating all cable drops ID's within four **(4) business days of completing the work**.

.2 The report will indicate for each horizontal cable when it was tested successfully, the result and the length.

.3 There shall be a copy of this communication specification along with all drawings on the job site at all times during the length of the project.

3.12 SITE CLEAN-UP

.1 The Communication cabling contractor is responsible for removing all trash including, cabling, cardboard boxes and all other cabling debris to outside garbage containers on a daily basis by the end of each day or as needed during the course of the day. No trash or debris is to be left in any of the telecommunications rooms. This includes removing trash cans or other forms of garbage collection devices at the end of each day. Communication Cabling Contractor shall provide a complete clean up of the rooms.

.2 Workstation outlet location areas shall be cleaned on an on-going basis each time the Communication Cabling Contractor completes any activity in the area.

3.13 AS-BUILT DRAWINGS

.1 The Communications Cabling Contractor shall provide **two (2) marked up cable drawings** for the floor indicating all cable drops ID's **five (5) business days prior** to the cutover weekend.

.2 Once the cutover has been completed the Communications Cabling Contractor will provide two (2) soft copies in AutoCAD Release R2500 or better format and a total of two (2) plotted sets of drawings for the client after the Communications Consultant review of the drawings.

.3 All documentation must be submitted to the Communications Consultant within ten (10) business days of the completion of the project. The documentation (test results, drawings) will be reviewed and, once approved by the Communications Consultant, the holdback will be released.

.4 At the completion of the cabling project a copy of the floor plan will be left in the cabinet by the Communications Cabling Contractor. This floor plan is to accurately reflect the final cabling system including tray routing and cable workstation identification numbers.

.5 The floor plan provided by the Communication Cabling Contractor within 2 weeks of migration.

.6 Once approved by the communications consultant, the Communications Cabling Contractor will to provide the client with the following:

.1 Two sets of drawings for the client.

.2 One set of drawings for the Communications Consultant.

3.14 TEST RESULTS

.1 Test documentation shall be provided on permanent media within three weeks after the completion of the project. The media shall be clearly marked on the outside front cover with the words “Project Test Documentation”, the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or connector) ID, measurement direction, reference setup, and technician name(s). The test equipment name, manufacturer, model number, serial number, software version, and last calibration date will also be provided. Unless the manufacturer specifies a more frequent calibration cycle, proof of annual calibration must be documented for all test equipment used in this installation.

.2 The test equipment shall meet the requirements found in the TIA/EIA-568-C series of standards.

.3 Printouts generated for each cable by the test equipment shall be submitted as part of the documentation package. Alternately, the Communications Cabling Contractor may furnish this information in electronic format on permanent media. The media shall contain the electronic equivalent of the test results as defined by the bid specification, in a file format compatible with Microsoft Word (version 6.0).

.4 When repairs and re-tests are performed, the problem(s) found and the corrective action(s) taken shall be noted. Both the failed and passed test results shall be documented and provided with the final test results. No penalties will be applied for corrective action prior to substantial completion of the project.

3.15 CHANGE NOTICES

.1 All change notice pricing will include a detailed breakdown including the following:

Part number
Unit Cost
Labour Costs as per APPENDIX B
PST
Mark ups for overhead and profit as per APPENDIX B of this document
Total price of the Change Notice

3.16 CUTOVER SUPPORT

.1 One (1) technician will be on site the day after cutover (8am to 5pm). Refer to construction schedule and project information from GC for more information.

.2 The Communications Cabling Contractor’s technicians will be required to be on site equipped with all necessary tools, including test equipment, answer questions and test any cables identified by the client or the Communications Consultant. Repair any deficiencies that arise from the weekend of the cutover.

.3 All work activity will be updated on the As Built drawings after the weekend cutover.

PART 4 – WARRANTY AND SERVICES

4.01 QUALIFICATION OF SYSTEM

.1 The installed horizontal cabling system shall be covered by the Manufacturer's Certification, issued by the successful manufacture and delivered by the Communications Cabling Contractor to the client.

.2 The installed horizontal cabling system shall conform to all applicable local building and electrical codes.

.3 The manufactures representative shall attend the site, as appropriate, in order to inspect the installation of the various phases of the project and to confirm that the installation is being performed in accordance with the manufacturer's installation guidelines. The manufacture shall provide documentation, if required, evidencing the date and time that such inspections were performed and the results of such inspections.

4.02 20-YEAR COMPONENT WARRANTY

.1 The manufacture shall provide a minimum twenty (20) year warranty for all manufactured passive components used in the installation of the 250MHz cabling system. Defective and/or improperly installed products shall be replaced and/or reinstalled at no cost to the client.

4.03 CERTIFICATION

.1 To qualify for System Certification, the manufacture of the 250MHz system shall be designed, installed, and tested by the Certified Communications Cabling Contractor for this project.

.2 To qualify for System Certification, the installed cabling system shall fully comply with all relevant manufacturer design and applications guidelines, including any pre-approved deviations as specified in the latest release of the manufacture Certification Guide.

.3 To qualify for System Certification, only products made or approved by the cabling manufacturer shall be used to ensure the end-to-end performance of the manufacturer's cabling system. The manufacturer's minimum 20-Year Component Warranty and Lifetime Application Assurance can only be provided to installations consisting of products supplied by the manufacture of the cabling system.

.4 The successful manufacturer will not provide certification or warranty coverage for products manufactured by other entities.

.5 The Communications Cabling Contractor will provide a pre-approved draft of the manufacturer's Letter of Certification within two weeks of award of this project. The document must include the following:

.1 Verification of the performance of the installed cabling system.

.2 Manufacturer's Certification Number.

.3 Identification of the Installation by location and project number.

4.04 LIFETIME APPLICATION ASSURANCE

.1 The cabling system certification shall provide the assurance that all present and future commercially available applications engineered for the performance level of the installed cabling system will work for the lifetime of the certified cabling system manufacturer.

.2 Should the certified cabling system fail to support the networking technologies designed to operate over it at the time of cutover, during subsequent use, or after upgrading active network devices the cabling manufacturer and the Communications Cabling Contractor shall take prompt corrective action at no cost to the owner.

4.05 OWNER RESPONSIBILITY

.1 The Communications Cabling Contractor shall provide a cabling system user manual to the owner of the cabling system. This document describes essential system elements and specifies the owner's responsibilities for maintaining the integrity of the installed cabling system over time. The cabling user manual contains guidelines for cabling system modifications (e.g., relocations, additions, changes to services), in addition to labeling and record-keeping maintenance requirements.

.2 The owner of the cabling system accepts that the benefits offered by System Certification are revoked if non-approved products are introduced to the installed cabling System. To regain System Certification in such cases, a certified cabling contractor must apply and validate all corrective modifications deemed necessary by the cabling manufacturer.

APPENDIX A:

PRODUCT LIST

BILL OF MATERIAL

Please submit a ***detailed Bill of Materials*** with the proposed components as indicated below. The cabling contractor is to provide a Bill of Materials (BOM) with their project pricing that reflects the following format:

Cable Information	Quantities
Total number of data cables (workstations)	
Total number of data cables (wireless)	
Total number of data cables (cameras)	
Grand Total of data cables	

Product Description	Part Number	Quantity

BASE PRICE BREAKDOWN:

Total Material Cost	$
Total Labour Cost	$
Total Misc. Cost	$
Total Project Cost (excluding HST)	$

APPENDIX B:

UNIT PRICES

The unit prices supplied below will be used for all additions, deletions and/or changes to the enclosed Scope of Work. The contractor will include all materials, labour, testing, overhead, profit, permits and incidental fees to supply and/or install the items listed for a 250 MHz cabling solution. All components used in the Unit Pricing shall be the same as specified in this document.

	ADD	DELETE
Supply, install and test one additional wall/floor/furn outlet complete with one (1) 250MHz-4pr CMR cables. Cable length to be 250 feet.	_____/each	_____/each
Supply, install and test one additional wall/floor/furn outlet complete with two (2) 250MHz -4pr CMR cables. Cable length to be 250 feet.	_____/each	_____/each
Supply, install one 24 port angled type patch panel. (colour black) (un populated)	_____/each	_____/each
Supply, install one 48 port angled type patch panel. (colour black) (un populated)	_____/each	_____/each
Supply only, 250MHz patch cables at 4 feet. (Blue/Green/yellow)	_____/each	_____/each
Supply only, 250MHz patch cables at 7 feet. (Blue/Green)	_____/each	_____/each
Supply only, 250MHz patch cables at 10 feet. (Blue/Green)	_____/each	_____/each
Supply and install one data cabinet (match existing)	_____/each	_____/each

Note: The data cables will be terminated on angled type patch panels (include the RJ45 module in the unit pricing for the data cable). Include all necessary hardware, labels, labour and testing in your unit pricing.

Indicate the profit percentage and overhead that will be used for material on all changes, not covered under unit prices, for the duration of the project.

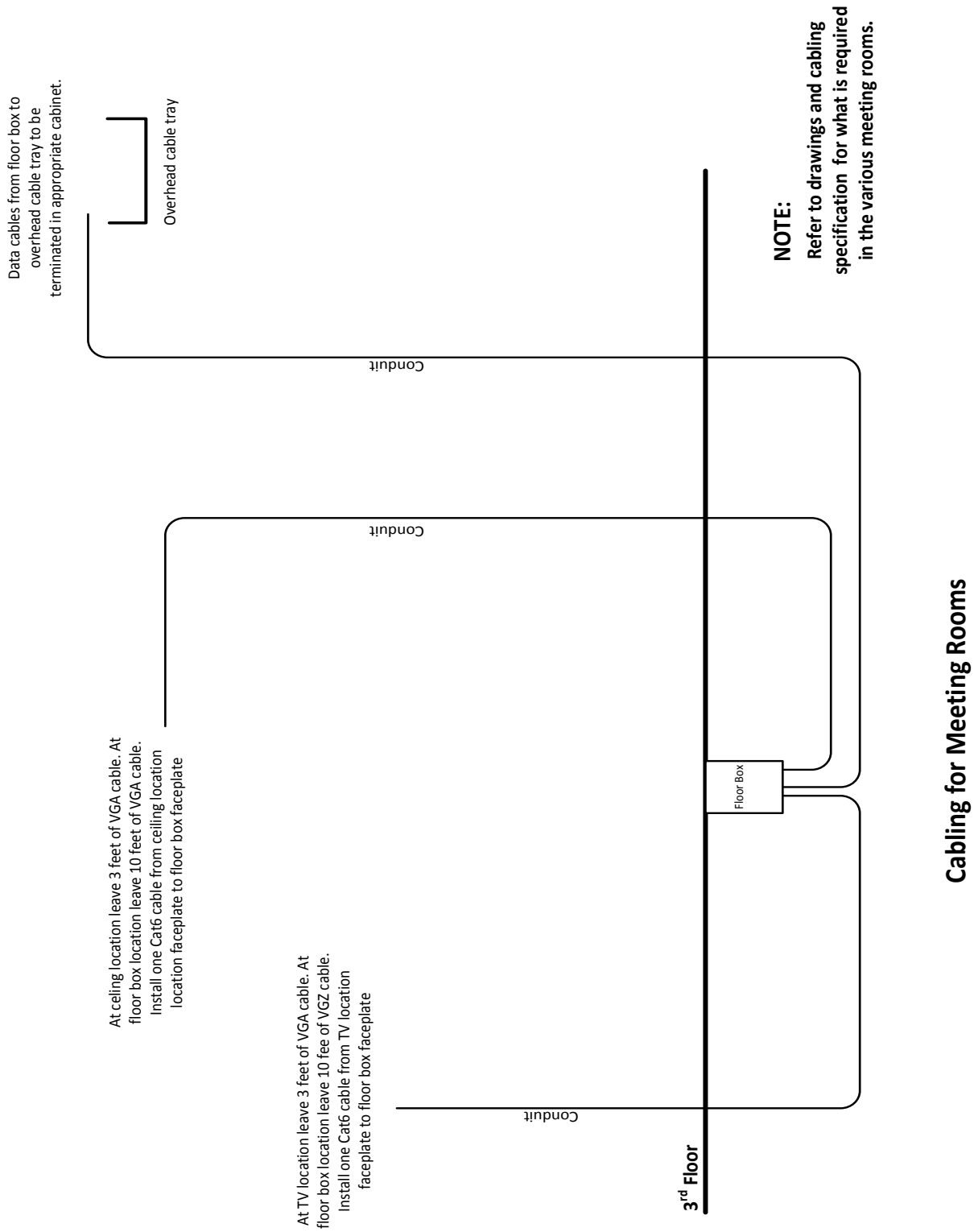
_____%Overhead _____% Profit

Indicate the labour rate that will be used on all changes, not covered under unit prices, for the duration of the project.

This rate includes all overhead and profit.

$_____ /hr Regular Time $_____/hr Overtime $_____/hr Shift Premium

PART 5 – SKETCHES


Data cables from floor box to overhead cable tray to be terminated in appropriate cabinet.
Overhead cable tray
Conduit
Conduit
Conduit
At celing location leave 3 feet of VGA cable. At floor box location leave 10 feet of VGA cable. Install one Cat6 cable from ceiling location location faceplate to floor box faceplate
At TV location leave 3 feet of VGA cable. At floor box location leave 10 fee of VGZ cable. Install one Cat6 cable from TV location faceplate to floor box faceplate
Floor Box
3rd Floor
NOTE:
Refer to drawings and cabling specification for what is required in the various meeting rooms.
Cabling for Meeting Rooms

CABINET LAYOUT

1 Overhead Cable Tray
2 Data Cabinet
3 Vertical Wire Managers with doors
4 24/48 Port Cat6 Angled Modular Patch Panels (Data)
5 Not Used
6 Cat6 Patch Cord (Data)
7 Network Data Switch (by others)
8 Fiber Patch Panel
9 24 Port Cat6 Angled Modular Patch Panels (Wireless/Cameras)
10 Network UPS (by others)

Drawing is for demonstration purposes only
(Contractor to review floor drawings for quantities)

D2L Meeting Room Info

Nov 22 2013

Room Type	Floor Monument (FM)	TV Data	VGA Cable	Ceiling Location (CL) Projector	Total cables at FM
MR 301	Yes 2 data (A/B) 1 data (A)	Yes 1 data FM to TV location	Yes 3 feet at TV wall location 10 feet at FM	No	4 + VGA
MR 310	No	No	No	No	
MR 311	No	No	No	No	
MR 312	No	No	No	No	
MR 317	Yes 2 data (A/B) 1 data (A)	No	Yes 3 feet at CL location 10 feet at FM	Yes 1 Data	4 + VGA
MR 318	Yes 1 location 2 data each (A/B) 1 Data (A)	No	Yes 3 feet at CL 10 feet at FM	Yes 1 data cable from FM to CL	4 + VGA
MR 319	Yes 1 location 2 data each (A/B) 1 Data (A)	No	Yes 3 feet at CL 10 feet at FM	Yes 1 data cable from FM to CL	4 + VGA
MR-322	Yes 2 data (A/B) 1 Data (A)	Yes 1 data FM to TV location	Yes 3 feet at TV wall location 10 feet at FM	No	4 + VGA
MR-323	Yes 2 data (A/B) 1 Data (A)	Yes 1 data FM to TV location	Yes 3 feet at TV wall location 10 feet at FM	No	4 + VGA
Media Collab Area	No 2 data (A) at each furniture faceplate location. Refer to electrical details	4 locations From data faceplate location on furniture to TV location install 1 data (A) cable. Refer to electrical details	Yes 3 feet at TV location and terminated in faceplate at furniture location. Refer to electrical details	No	 3 data + VGA at each faceplate location